Cassandra & Akka

IndyScala, August 5, 2013

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CROWDSTRIKE

What is Cassandra?

- A persistent Map[A, SortedMap[B, C]]*
- distributed
- fault tolerant
- tunably consistent
- FAST!

** Oversimplification. Bear with me.*

Let's build a system that...

1. Ingests the Twitter Sample API*
2. Detects the language of the tweets
3. Create a searchable index, by language
4. Records info about users:
   a. Their interests (#hashtags)
   b. People who talk to them (@mentions)
   c. The languages they tweet in

** I'm not worthy of the firehose*

Our schema

tweets	
tweet_id (PK)	bigint
text	text
username	text
lang	map<text, text>

tweet_terms	
term (PK)	text
lang (PK)	text
tweet_id (PK)	bigint
username	text
text	text

user_profiles	
username	text
languages	set<text>
hashtags	set<text>
mentions	set<text>

counters	
name	count

How do you define it?

CQL3 DDL looks a lot like SQL DDL:

```
create table tweets (
  tweet_id bigint primary key,
  text text,
  username text,
  lang map<text, text>
);
```

How do you query it?

CQL3 DML looks a lot like SQL DML:

```
INSERT INTO tweets (tweet_id, text, username)
VALUES (?, ?, ?);

SELECT * FROM tweets WHERE tweet_id = ?;
```

But it’s not relational

- No check constraints on columns
- No foreign keys to other tables
- Not normalized.
- Not even in 1NF!!!

So it doesn't do...

- joins
- subqueries
- like queries
- most forms of aggregation
- filtering by non-PK columns*
- range queries on PK**
- ordering by column value***

* without a secondary index

** you can, with an inefficient config

*** unless it's the second column of the primary key

That sucks!

- Yeah, at first, if you're a relational guy, it does suck.
- Think in terms of the data structure.
  - Review: Map[A, SortedMap[B, C]]
- Think in terms of how query that structure.*
- Don't fear denormalization.
- You don't have to give up your other DBMS.

* If you take away one thing from this whole evening, take that.

Seems limiting...

But it's also freeing.

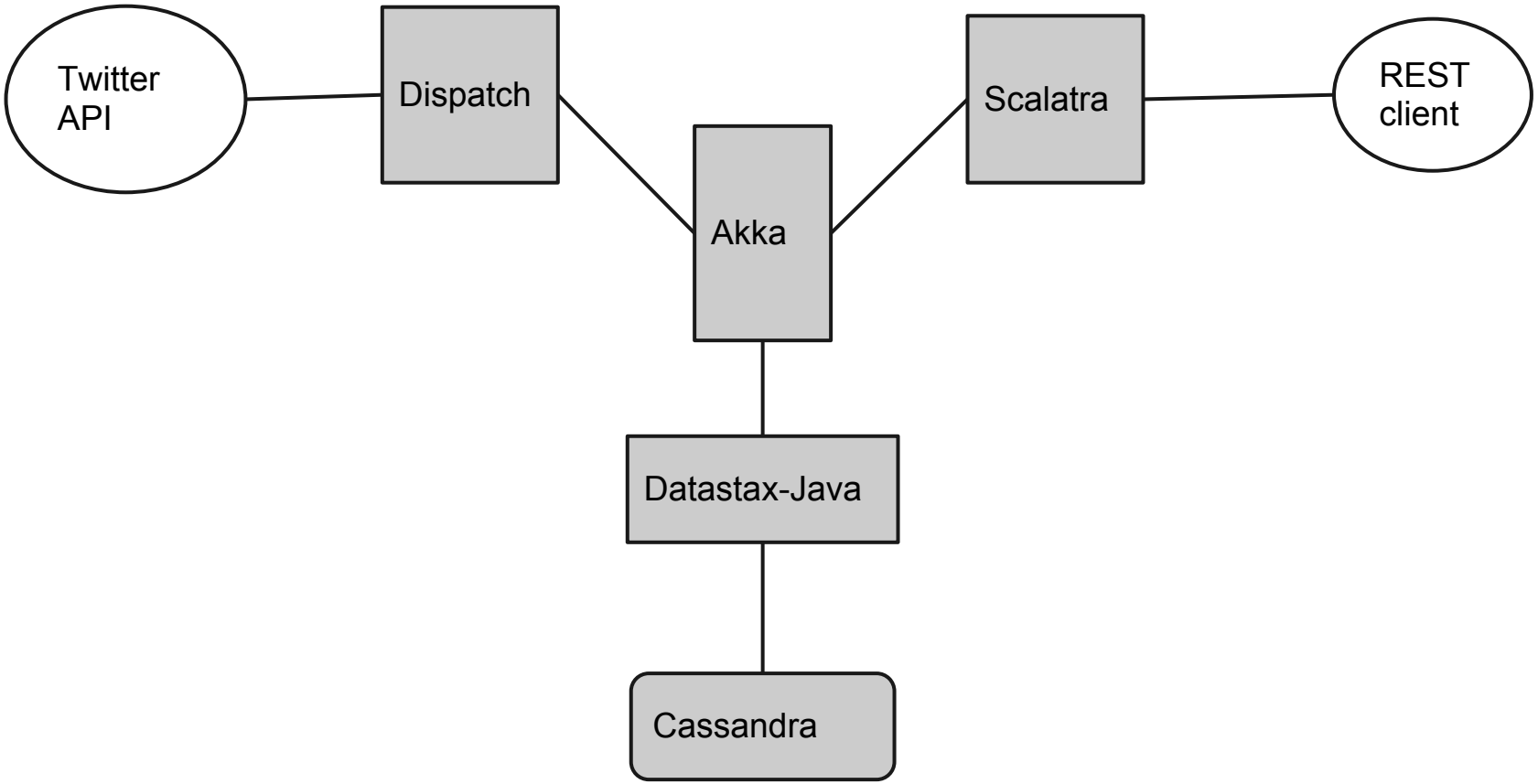
- Sharding is intrinsic.
- Replication is intrinsic.
- Add nodes dynamically. *
- Available if some nodes fail. **
- Available if Godzilla rampages through one of your data centers. ***

* Not a cheap operation, but no downtime.

** How many? Depends on your *replication factor.*

*** If you set up replication across centers, and if Godzilla doesn't get them all.

Architecture



Walk through the code

Open your browsers and follow along as we discuss the important classes.

https://github.com/indyscala/cassandra-demo/tree/master/src/main/scala/indyscala/aug2013

source.TwitterSample

- Uses Dispatch to connect to the Twitter Sample API.
- Parses each line of the streaming response with json4s.
- Executes a callback function. In our case, we send it to the Twitter Service.

service.TweetService

- Our central nervous system.
- Supervises our subservices:
  - tweet parser actor
  - data store actor
  - language detector actor
  - indexer actor
- Knows how to route:
  - incoming JSON messages from the TwitterSample
  - parsed tweets from the
  - incoming queries from Scalatra
  - results from the language detection actor
  - results from the index actor

service.JsonParser

- Knows how to construct a tweet from a JSON value.
- Actually, the smarts are built into extractors in the model package.
- Important point: feeds recognized Tweets back into the TweetService.

service.LangDetector

- Detects languages from two sources
  - Twitter gives us its best guess
  - Analyzes with Cybozu Labs' LangDetect, an open source project.
- Does the detections in parallel, and reports back to the TweetService to store the results and trigger indexing.
- Adding an HTTP services for a third opinion via Dispatch would be easy.
  - 10% of my speaker fee of $0 bought us 0 such services.

service.Indexer

- Triggered when:
  - a tweet is parsed (for any-language searches)
  - a language is detected
- Yes, yes, caching parsed tweets may have been more efficient. But this approach was simple.
- Yes, yes, the index table is repetitious. But it's efficient in Cassandra. Forget your relational instincts!

service.DataStore

- Finally... this actor is why we're all gathered here tonight.
- All Cassandra interaction happens in this actor.
  - That's not necessary. I have lots of actors that talk to Cassandra at work. This is a simple app.
- It's all non-blocking. Great fit for Akka.
- DataStax's Java driver is nice, but you deal with some types you left behind when you left Java behind...

util.DataStaxImplicits

- Implicits to the rescue!
- Adapt Guava's Listenable Future to scala.concurrent.Future, makes working with Cassandra feel like a first-class citizen in Akka.
- Map ResultSets over an arbitrary function, to feel more like a Scala collection.
  - Map straight to json with json4s, because that's what we usually do.

util.DataStaxExtension

- Provides a way for multiple actors to share a Cassandra connection pool.
  - Only one actor type talks to Cassandra in this demo, but we have more than one instance of it.
- It’s convenient like a global, but it’s scoped to the ActorSystem.
  - We only have one ActorSystem, but you’ll really appreciate this when you start writing tests.

servlet.TwitterServlet

- A simple Scalatra service to define a few REST endpoints and query the service.
- Sends query messages to the TwitterService, and renders the returned JSON.
- Yes, Virginia, there is asynchronous support in the Servlet API.
  - Are you the same person you were in 1997? Neither are Java Servlets.

What still hurts

- Typing
  - Known invalid CQL3 types can be bound. In native Scala, we'd have a type class here.
  - Collections are Java collections, and because of the Any type, we have to convert them before binding.
- Positional parameters. Eek!
- Anorm has done a nice job applying a Scala sheen to raw JDBC. Something similar for talking to Cassandra would be a big win with little added complexity.

Immaturity

- Don’t panic. I’ve not lost any data yet.
  - But some things aren’t implemented yet. Like prepared statements with a dynamic limit. Sometimes we’re stuck with *gasp* String concat.
- Some of the immaturity is in me.
  - A dozen years of RDBMS wisdom was hard earned, and picking Cassandra means starting over.
- Some of the immaturity is in us all.
  - Nobody has a dozen years of Cassandra wisdom, because it’s not a dozen years old. We’re all learning as we go.

In conclusion

- I work with Big Data. Cassandra is doing things for us that PostgreSQL simply can't.
- But sometimes I need ad hoc queries on smaller data sets, and PostgreSQL is still really great at that.
- It's okay to use them both. *NoSQL means Not Only SQL.*
  - And with Akka and future comprehensions, you've got a great toolset to join them in your application.

Does this look like fun?

- I work with Cassandra, Akka, Json4s, Scalatra, and Dispatch every day at CrowdStrike.
- We're a distributed team.
- And we're hiring!

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Thanks and good night

- Thanks to E-gineering for hosting.
- Thanks to Brad Fritz (@bfritz) of Fewer Hassles for organizing

- Once again, I'm @rossabaker
  - Also rossabaker on Freenode IRC. I'd love to chat.
- Materials: http://github.com/indyscala/cassandra-demo